Remarque : montrons que $q(t) = Q_m .\sin\left(\omega_0 t + \varphi_q\right)$

Est solution de cette équation

$$\frac{dq}{dt} = Q_{max}\omega_e \cos\left(\omega_0 t + \varphi_q\right)$$

$$\frac{d^2q}{dt^2} = -Q_m .\omega_0^2 .\sin\left(\omega_0 t + \varphi_q\right)$$

$$\Rightarrow \frac{d^2q}{dt^2} = -\omega_0^2 q \Rightarrow \frac{d^2q}{dt^2} + \omega_0^2 q = 0$$

$$\text{d'où } \omega_0^2 = \frac{1}{LC}$$

b-On remplace **q** par $C.u_c$.

$$LC\frac{d^2u_c}{dt^2} + u_C = 0 \Rightarrow \frac{d^2u_c}{dt^2} + \frac{1}{LC}u_c = 0$$

c- La pulsation propre $\omega_0 = \frac{1}{\sqrt{LC}} = 10^3\,rad.s^{-1}$

La période propre : $T_0 = \frac{2\pi}{\omega_0} = 2\pi\sqrt{LC} = 2\pi.10^{-3}\,S.$

d- $q(t) = Q_m \sin\left(\omega_0 t + \varphi_q\right)$

$Q_m = Q_0 = 10^{-5}\,C =$ amplitude.

$\omega_0 = 10^3\,rad.s^{-1}$.

$t = 0$: $q(0) = Q_{max} \sin \varphi_q = Q_{max}$

$\Rightarrow \sin\varphi_q = 1$ d'ou $\varphi_q = \frac{\pi}{2}$ en C

$q(t) = 10^{-5}\sin\left(10^3 t + \frac{\pi}{2}\right)$

$$i(t) = \frac{dq(t)}{dt} = 10^{-2}\cos\left(10^3 t + \frac{\pi}{2}\right) = 10^{-2}\sin\left(10^3 t + \pi\right)$$

Remarque : $q(t) = Q_{max}\sin\left(\omega_0 t + \varphi_q\right)$

$$i(t) = \frac{dq}{dt} = Q_m\omega_0 \cos\left(\omega_0 t + \varphi_q\right)$$

$$= I_{max}.\sin\left(\omega_0 t + \varphi_q + \frac{\pi}{2}\right) \quad \text{en A}$$

$I_{max} = Q_{max}\omega_0$

$\varphi_i = \varphi_q + \frac{\pi}{2}$ (en quadrature)

$$u_c(t) = \frac{q(t)}{c} = \frac{Q_{max}}{C}\sin\left(\omega_0 t + \frac{\pi}{2}\right)$$

$u_C(t) = 10\sin(10^5 t + \frac{\pi}{2})$ en V.